

CLAIMS:

1. A pull-up circuit, comprising:
an operational amplifier, having a reference voltage input connected to a first input thereof; and
a first transistor, controlled by the output of the operational amplifier, the first transistor having a first terminal connected to a first supply voltage input and having a second terminal connected to a pull-up circuit output and to a second input of the operational amplifier;
such that, when the operational amplifier is enabled, it acts to bring the voltage on the pull-up circuit output equal to the voltage on the reference voltage input.
2. A pull-up circuit as claimed in claim 1, further comprising a plurality of diodes, connected in series between the first supply voltage input and ground, with the reference voltage input connected at an intermediate point in said series connection of diodes.
3. A pull-up circuit as claimed in claim 1 or 2, wherein the first input of the operational amplifier is the non-inverting input, and the second input of the operational amplifier is the inverting input.
4. A pull-up circuit as claimed in claim 1, 2 or 3, wherein the first transistor is an NMOS transistor.
5. A pull-up circuit as claimed in any preceding claim, further comprising:
a second transistor, having its conducting path connected between the first supply voltage input and the output of the operational amplifier, controlled such that it is turned off while the operational amplifier is enabled.
6. A pull-up circuit as claimed in claim 5, wherein the second transistor is a PMOS transistor.

7. A pull-up circuit as claimed in any preceding claim, further comprising:
a pull-up resistance, switchably connected between a second supply voltage
input and the pull-up circuit output; and
logic circuitry, for determining whether a voltage on the second supply voltage
5 input is greater than a threshold voltage and,
when it is determined that the voltage on the second supply voltage input is
greater than the threshold voltage, for disabling the operational amplifier and for connecting
the pull-up resistance between the second supply voltage input and the pull-up circuit output,
and
10 when it is determined that the voltage on the second supply voltage input is
not greater than the threshold voltage, for enabling the operational amplifier and for
disconnecting the pull-up resistance.
8. A pull-up circuit as claimed in claim 7, wherein the pull-up resistance is
15 switchably connected between a regulated voltage obtained from the second supply voltage
input and the pull-up circuit output.
9. A pull-up circuit as claimed in claim 7 or 8, wherein the pull-up resistance
comprises first and second resistors connected in parallel between the second supply voltage
20 input and the pull-up circuit output when the pull-up circuit is in idle mode, and wherein one
of said resistors is deactivated to thereby increase the pull-up resistance when the pull-up
circuit is in active mode.
10. A USB transceiver, comprising a pull-up circuit as claimed in claim 1,
25 wherein the first terminal is connectable to a USB bus voltage.
11. A USB transceiver, for use in a USB Device, the USB transceiver comprising
a pull-up circuit as claimed in claim 7, wherein the first terminal is connectable to a USB bus
voltage, and wherein the second supply voltage input of the pull-up circuit is connectable to a
30 power supply of the USB Device.
12. A USB transceiver, as claimed in claim 11, further comprising a DC-DC
converter, for forming a regulated voltage from the power supply of the USB Device,

wherein the pull-up resistance is switchably connected between the regulated voltage and the pull-up circuit output.

13. A USB transceiver as claimed in claim 10, 11 or 12, comprising a first pull-up
5 circuit having its pull-up circuit output connected to a D+ line of a USB Device, and a second
pull-up circuit having its pull-up circuit output connected to a D- line of a USB Device.

14. A transceiver as claimed in any one of claims 10 to 13, suitable for use in a
USB on-the-go device.

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15. A USB device, comprising a USB transceiver as claimed in any one of claims
10 to 13.

16. A USB on-the-go device, comprising a USB transceiver as claimed in any one
15 of claims 10 to 13.